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Intravenous Fluid Technique in Infancy

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Outside the children's hospital, the administration of intravenous fluids in babies is fortunately an unusual necessity. Rightly, subcutaneous fluids given with hyalase are used extensively in the milder cases of dehydration and are usually sufficient to correct the imbalance.

However, in infants severely dehydrated from, for example, gastroenteritis or pyloric stenosis, in those with peripheral vascular failure from overwhelming toxaemia, in cases of severe haemorrhage and in burns and other surgical problems, the need for an intravenous "drip" arises, often with great urgency. Generally a "cut-down" will be performed over the ankle, often after several time-consuming but unsuccessful attempts at "push-ins" in arm, wrist or scalp. As like as not, the "cut-down" drip, when completed, will be found to be delivering only a niggardly five drops per minute, despite the injection of a local anaesthetic to relax venous spasm and with the infant's condition steadily deteriorating.

This communication will draw attention to some principles and techniques which have been found successful in dealing with problems of this sort.

THE "CUT-DOWN"

In surgical cases, including severe burns, where the problem of transportation to the operating theatre arises and where the need for parenteral fluid therapy will persist for several days or longer, there is no doubt that a "cut-down" should be done without preamble. The only really satisfactory method is that using polyethylene tubing, which can be pushed well up the saphenous vein and provides a pliable communication (via a screw-type ureteric catheter adapter) to the "drip" tubing. A "drip" of this sort, if performed aseptically, runs well for long periods. The limb need not be splinted and there is no leakage.

However, the common run of dehydrated babies, mostly cases of gastroenteritis, should not require such mutilation. Even in very severe cases it has been found unnecessary to leave the infant with an unsightly scar and a fibrosed vein. By using the procedure to be outlined, a satisfactory site for delivery of fluid via a needle can almost always be found.

SHORT-TERM INTRAVENOUS INFUSION:

THE KAUFMANN SYRINGE

The method is based on the premise that a baby sufficiently dehydrated or exsanguinated to require intravenous fluid replacement will derive most benefit if part of this fluid is replaced fairly quickly. Hence about 25 ml./kg. are allowed to run in in the first 20 to 30 minutes. The Kaufman syringe (Fig. 1) is a small all-glass syringe of 2 ml. capacity with a side outlet to which the rubber or plastic tubing

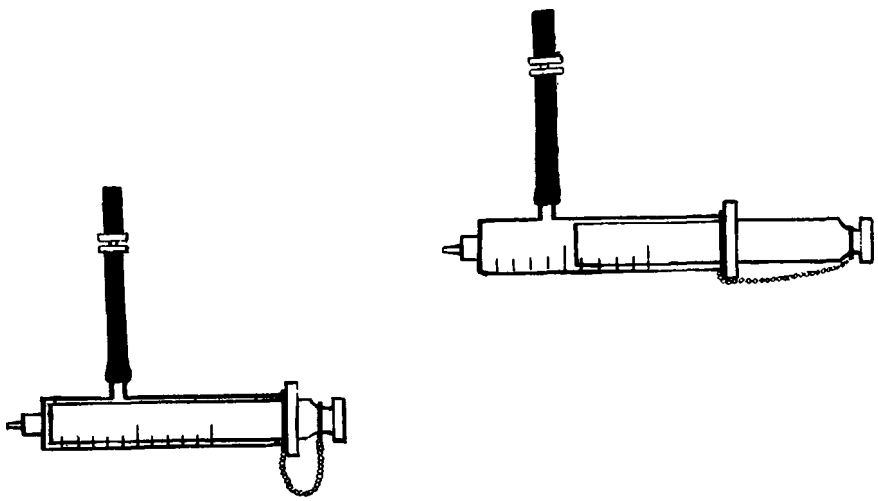

Fig. 1—The Kaufmann syringe.

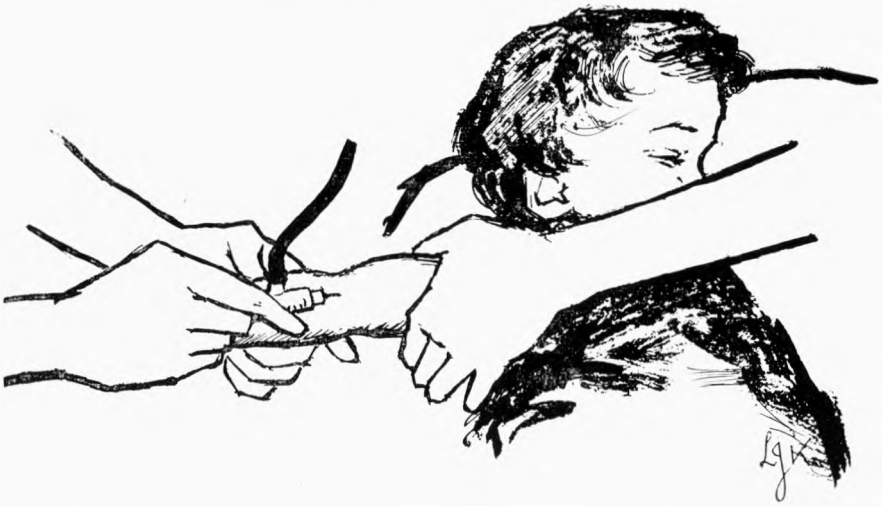

Fig. 2.

of the infusion set is attached. On entering a vein (as one would with an ordinary syringe and needle) the plunger is withdrawn slightly, or twisted, in the Luer-Kaufmann pattern. establishing continuity between infusion, syringe and vein. The syringe is then held *in situ* until the required amount of fluid has run in. At first this will probably flow in a continuous stream and will need to be slowed to 60 to 90 drops a minute. It must be emphasised that such a rate of flow is in no way harmful to a dehydrated baby and faster rates may be used with safety in the initial minutes. While it would seem time-consuming to spend 20 or 30 minutes holding the syringe in place while the fluid flows in, the whole procedure from beginning to end takes little longer than a "cut-down." Apart from its great usefulness in pediatrics, this instrument would also simplify intravenous work in adults.

The type of needle used varies with the site of the infusion. Best results are obtained if the

Fig. 3.

needle has a short bevel and is of the largest practicable bore for the particular vein used. However, shortness in length makes for greater accuracy in handling, and the stock sizes of "hypodermic" and "serum" needles are all relatively too long for the respective bores. Both bevel and length of needle can conveniently be adjusted with a small revolving hone. A selection of suitable needles, meticulously sharpened, are kept, with a Kaufmann syringe in a metal container, autoclaved and ready for use.

The most suitable site for this technique is the antecubital vein. This is very prominent in young infants without much subcutaneous fat, but less so in older babies. However, with an adequate period of obstruction to the venous return the vessel can usually be palpated if not seen. A more distal vein, such as one on the back of the hand, may be used similarly, but the larger vein should be preferred, as a brisk flow of fluid is thus assured. With the fingers of the left hand behind the infant's elbow, the thumb extends the forearm and holds skin and vein taut. The skin is then entered a short distance distal to the proposed point of entry into the vein (Fig. 2).

The most suitable needle is a "serum" No. II or III, cut to 1¼ inches.

The External Jugular Vein

This vessel is available even in fat babies when no other vein can be coaxed to reveal itself. Its use is quite safe and the technique easy if the child is efficiently immobilised. He is first wrapped in a blanket to secure the arms and legs, then placed by an attendant across a cot or small table with the head slightly extended over the edge (Fig. 3). A small pad or pillow is inserted beneath the shoulders and neck, partly to make the head more dependent and partly to pad the table-edge, if this is used. The operator seats himself at the child's head, which is then turned to one or other side with the left hand, while the attendant pulls the appropriate shoulder slightly downwards. By this means the external jugular is elongated and straightened, becoming greatly engorged when the child struggles or cries. The needle of

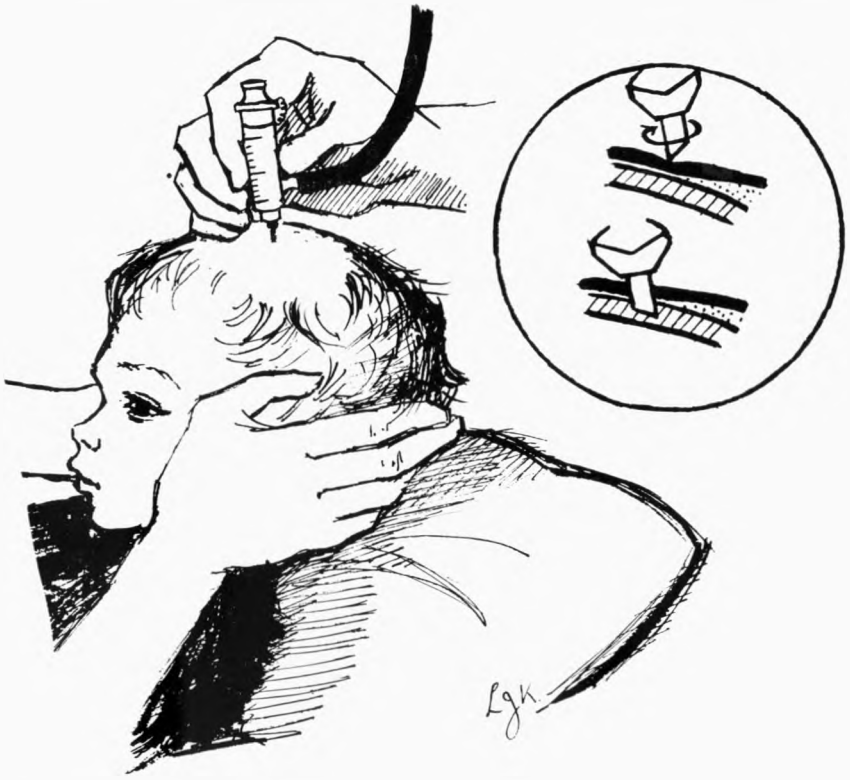

Fig. 4—After piercing the skin, the bevel is rotated through 180° (inset).

choice is again a "serum" No. II or III. The vein is entered as near to the angle of the jaw as possible and advanced half to one inch into its lumen.

Scalp Veins

In young or marasmic infants these are usually the most convenient and easy veins to employ in this method. They are also the most suitable for a long term infusion (see below). A segment of scalp above one ear is shaved and the infant positioned in the same way as in the jugular vein puncture. The needle used is a "hypodermic" No. 12, 1 or 2, cut to half to three-quarters of an inch. Being extremely thin-walled, scalp veins often dilate up to five or six times their size during a rapid infusion; this must not be mistaken for a leakage of fluid into the tissues. Particular care should be taken not to enter one of the superficial temporal arteries in error (Fig. 5 (a)).

The Sagittal Sinus

In the desperate emergency this route may be used in practised hands, provided the anterior fontanelle is patent. A measure not lightly to be embarked upon, entry into the sagittal sinus nevertheless forms a very valuable last line of defence. In Manchester, Gaisford has used it effectively for many years. A circular area of scalp, at least three inches in diameter, centred on the posterior angle of the anterior fontanelle, is shaved and prepared. The infant lies on his back, wrapped in a blanket, with the head supported and flexed at an angle of 45 degrees to the horizontal, in the cupped hands of an attendant. Using a "serum" No. 0, I or II needle, cut down to three-eighths of an inch, the skin is entered at an angle of 45 degrees, over the posterior angle of the fontanelle exactly in the midline. The Kaufmann syringe is thus held quite vertically (Fig. 4), with the needle bevel facing posteriorly (Fig. 4 inset). After piercing the skin the syringe is rotated through 180 degrees and the needle point gently coaxed through the fontanelle at its posterior angle. This ensures that the bevel will lie parallel with the sinus and minimises the risk of the point puncturing its lower margin. If, on withdrawing the plunger with the left hand, blood is not freely obtained, the syringe is immediately withdrawn and the procedure repeated more anteriorly.

Long-Term Intravenous Infusion

After the rapid infusion is completed, subsequent procedure depends on the requirements in each case.

(a) In most cases the needle may be removed and subsequent fluids replaced by the oral or subcutaneous route. This is exemplified in the severely dehydrated infant with pyloric stenosis, where, after the rapid infusion of 75 millilitres

(a) (b) (c)

Fig. 5.

of solution containing equal parts of plasma and 5 per cent. glucose in water, a further 150 millilitres of fluid given subcutaneously will usually be all that is required to restore the infant to a fit state for the operation.

(b) If an external jugular or sinus has been used and the infant's condition is such that further intravenous fluids are required, the needle may be removed and the infusion restarted at a site more convenient for long-term use; for example, scalp, wrist or foot. By this time small veins not previously noticeable will usually be in evidence with the improved intravascular fluid volume. A needle can often be immobilised at the bend of the elbow, but this site is not generally suitable.

(c) "Plaster-of-Paris" technique. After employing a scalp vein the Kaufmann syringe may be removed, leaving the needle in the vein, and the tubing connected to the needle direct. This is facilitated if a metal "male and female" connection is present a short distance up the tubing (Fig. 1). After placing a small dressing soaked in collodion over the site of entry, a pad consisting of a few thicknesses of two-inch plaster of Paris bandage is moulded around the needle, connection and tubing. When this sets, two crossed pieces of half-inch adhesive plaster serve to hold the combination even more firmly in place (Fig. 5 (b) and (c)). A similar method may be used with the peripheral veins.

Summary

(1) The practice of wholesale "cutting down" in infants required the intravenous administration of fluids is condemned.

(2) A technique which greatly simplifies this procedure is described.

(3) It is felt that this technique, together with the use of the external jugular vein and sagittal sinus also described, may prove of considerable value in dealing with the severely ill African infants so often admitted to hospitals in this country.

Acknowledgment

It is a pleasure to record my indebtedness to Professor W. Gaisford, of Manchester, who taught me much of what is contained in this paper.